*ICONARP*
*International Journal of Architecture and Planning*
*Received: 15.08.2024 Accepted: 05.12.2024*
*Volume 12, Issue 2/ Published: 31.12.2024*
*Research Article* *DOI: 10.15320/ICONARP.2024.312 E- ISSN:2147-9380*
ICONARP

# Designing for the Future: The Relationship Between the Interior Design Profession and Sustainable Development Goals

**Kübra Kayaduran Mahir ***
**Duygu Koca****

## Abstract

Interior architecture has the potential to create social benefits by designing spaces that affect people's quality of life. The Sustainable Development Goals (SDGs) offer a framework to comprehend the profession's social and environmental responsibilities, and develop strategic approaches. This study aims to assess how the social impact of interior design aligns with the SDGs, offering an opportunity to explore the relation between discipline and sustainability in a comprehensive manner, considering both environmental and social dimensions. The profession's relations and contribution to the goals was evaluated through a review of current literature. To this end, the year 2015, when the Sustainable Development Goals were adopted, was chosen as the starting point and a bibliometric analysis of studies in the Web of Science database between 2015 and 2023 was carried out. In addition to the analysis function of the WOS database, the bibliometric analysis program Vosviewer was used for data analysis. The results of the analysis show that interior design has a strong relationship with goals such as Climate Action (SDG 13), Sustainable Cities and Communities (SDG 11), Responsible Consumption and Production (SDG 12), Good Health and Well-Being (SDG 3), and Affordable and Clean Energy (SDG 7). However, the relationships between Quality Education (SDG 4), Gender Equality (SDG 5) and Reduced Inequalities (SDG 10) are not yet at a sufficient level. The findings indicate that interior architecture has the potential to fulfill its social responsibility by supporting the Sustainable Development Goals. Furthermore, in order to foster a more inclusive relationship with the SDGs, Interior Architecture needs to evolve. It is expected that this will enable to create new perspectives and methodologies, both in professional practice and in the academic literature.

***Keywords:*** *Bibliometric analysis, Interior architecture, Literature review, Social responsibility, Sustainable development goals.*

**Department of Interior Architecture, Kütahya Dumlupınar University (DPU), Kütahya, Türkiye *(Corresponding author)*
E-mail: kubra.kayaduran@dpu.edu.tr

**Department of Interior Architecture and Environmental Design, Hacettepe University, Ankara, Türkiye
E-mail: duyguk@hacettepe.edu.tr

**To cite this article:** Kayaduran Mahir, K. & Koca, D. (2024). Designing for the Future: The Relationship Between the Interior Design Profession and Sustainable Development Goals. *ICONARP International Journal of Architecture and Planning,* 12 (2), 956-982. DOI: 10.15320/ICONARP.2024.312

## INTRODUCTION

The term "sustainable development" was first used in 1980 by the World Union for Conservation of Nature and Natural Resources (IUCN 1980). Subsequently, the Brundtland Commission Report (1987) and the Rio Earth Summit (1992) made sustainable development as a political goal for the global community. The Brundtland Report defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". The definition refers to an approach that balances economic growth, environmental protection, and social equity (WCED, 1987).

In 2000, the United Nations established the Millennium Development Goals (MDGs), which were aimed at being accomplished by 2015. These goals were created to address global issues like poverty eradication, food security, and improved health. At the meeting held in New York on 25-27 September 2015, the UN announced the Sustainable Development Goals (SDGs), which represent the continuation of the aforementioned goals and will set the UN's agenda until 2030. The new goals not only complement the MDG's commitments, but also offer a more expansive global agenda to advance sustainable development by focusing on a wider range of issues and universal goals (Blanc, 2015; Dewan, 2009; Sachs, 2012).



The 2030 Agenda for Sustainable Development provides a universal political framework with the objective of ensuring peace and prosperity for humankind and the planet for both the present and future generations. The overall objective of this agenda is to achieve 17 Sustainable Development Goals (SDGs) and 169 associated subgoals. The goals are a compelling call to action encouraging both developed and developing countries to collaborate globally and take measures to achieve these ambitious targets. The order of these 17 goals is as follows: No Poverty (SDG 1), Zero Hunger (SDG 2), Good Health and Well-Being (SDG 3), Quality Education (SDG 4), Gender Equality (SDG 5), Clean Water and Sanitation (SDG 6), Affordable and Clean Energy (SDG 7), Decent Work and Economic Growth (SDG 8), Industry, Innovation and Infrastructure (SDG 9), Reduced Inequalities (SDG 10), Sustainable Cities and Communities (SDG 11), Responsible Consumption and Production (SDG 12), Climate Action (SDG 13), Life Below Water (SDG 14), Life on Land (SDG 15), Peace, Justice and Strong Institutions (SDG 16), Partnerships for the Goals (SDG 17).

The objective of these goals is to eradicate poverty and other social deprivations, improve health and education, reduce inequalities, and foster economic growth. In addition, the SDGs include a number of action plans that are meant to combat climate change and safeguard oceans and forests. The interconnected and integrated nature of the SDGs focuses on balancing the economic, social, and environmental dimensions of sustainable development, defining them as an inseparable whole. The goals and targets have been established to encourage concrete action in

DOI: 10.15320/ICONARP.2024.312

areas of critical importance to humanity between 2015 and 2030. The SDGs' entire agenda is aimed at guiding all countries towards the actions required for future sustainability, while also promoting global cohesion and cooperation (United Nations, 2015). As a significant initiative, the SDGs represent a significant effort to make the world a more livable and sustainable. The importance of this idea is rising due to the environmental and social problems facing the world (Sachs, 2012).

Active participation in the Sustainable Development Goals at both the individual and societal level represents a fundamental social responsibility, one that is essential to the realization of a more sustainable world in the future. The social responsibility of the professions can be defined as the duty of professionals to consider the impact of their actions on others and to prioritize the welfare of society (Frankel, 1988). In this context, the Sustainable Development Goals (SDGs) can be considered as criteria that enable professionals to fulfill their social responsibilities.

One of the disciplines where social and environmental responsibility has a massive impact is design. It is imperative that designers adopt a socially and environmentally conscious approach that is sensitive to living beings, moving beyond the traditional profit-oriented approach. Designers have considerable impact on environmental and social issues through their design choices (Koo, 2016). Similarly, spatial design is a factor both in the construction of structures and related directly with individual preferences. In other words, the objective in the activities of the interior architecture profession should be to create solutions that will improve human life and support the sustainability of life on Earth. It is incumbent upon interior architects to accurately identify the spatial issues that arise in all aspects of life and to devise novel solutions to these problems. Therefore, interior architects have a responsibility to address the ecological and social problems facing the world through the production of space. The primary objective of professionals in this field should be to guarantee the continuity of life on Earth by making substantial changes in all aspects of life, thereby creating a more livable world for future generations (Andereas, 2019). Additionally, they have the opportunity to develop projects that contribute to sustainable development and enhance the general welfare of society (Anderson et al., 2007).



The responsibility to ensure our living spaces for future generations in environmental, economic and social dimensions places the consideration of the sustainability of interiors among the fundamental duties of interior architecture. The Sustainable Development Goals (SDGs) provide a set of criteria that will enable the profession to fulfill this task by enriching the design of interiors with considerations of energy efficiency, the use of environmentally sensitive materials, waste reduction and social equality and accessibility. These goals encourage interior designers to develop innovative and responsible design

solutions, thereby enabling them to fulfill their professional social responsibilities.

In this framework, the main aim of this study is to evaluate the social responsibility of interior architecture in the context of the Sustainable Development Goals (SDGs). To elucidate the relationship between the two by analyzing current literature on the subject. In this context, the research questions for the study are as follows:

1. Which disciplines and sustainable development goals are the research topic related, and how have these relationships evolved over time?

2. What is the geographical distribution of the research topic? What is the relationship between this distribution and sustainable development goals?

3. What are the major themes in the literature and the sustainable development goals with which the topics are related?

In order to address these questions, a systematic literature analysis was conducted to examine the developments, changes and focal points that occurred in the handling of the subject between 2015 and 2023. It is anticipated that the findings will illuminate both the theoretical and practical aspects of how interior architecture contributes to sustainable development. Additionally, it can provide insights on the potential evolution of the field's relationship with sustainable development goals.



A review of the literature on the relationship between sustainable development and interior architecture reveals a variety of research topics and approaches. The headings for these topics include sustainable design principles and practices, technological innovations and environmental sustainability, interior space and human welfare, and interior architecture education and curriculum development. In the first category, sustainable design principles and practices, studies are presented which delineate the fundamental elements of sustainable interior design (Ayalp, 2012; Sinha & Fukey, 2022) and which discuss the integration of sustainable design principles into Interior Architecture, together with the difficulties encountered in this process (Lee, 2014; Pilatowicz,2015). Furthermore, the necessity of incorporating sustainability indicators into interior design and integrative solutions that facilitate the transition to sustainable architectural design is emphasized (Sarmento & Souza, 2017; Celadyn, 2018).

Studies that focus on technological innovations and environmental sustainability have predominantly demonstrated the potential of smart technologies and innovative design solutions in sustainable interior design (Rashdan, 2016; Attia, 2018) according to the review of the literature. Furthermore, research has also concentrated on the implementation of sustainable strategies in interior architecture and the environmental and social consequences of such strategies (Ahmed, 2022; Sorrento, 2012). The aforementioned sources provide detailed accounts on how innovative design approaches and sustainable practices are implemented within this field. Another group of studies focuses on the

DOI: 10.15320/ICONARP.2024.312

selection of sustainable materials and their environmental impact (Hayles, 2015; Lee & Allen, 2013). These studies address the motives of interior designers to use sustainable materials, emphasizing the importance of material origin knowledge and environmental awareness. A substantial body of researches examining the topics of adaptive reuse, integration of reclaimed materials, resource efficiency, application of sustainable materials and their contribution to sustainable interior design has consistently highlighted the pivotal role of material innovations in interior design (Celadyn, 2019; Fathy, 2016; Linhares & Pereira, 2017; Mrinalini et al., 2023; Jeadi et al., 2023; Santoso et al., 2023; Van, 2018; Yang, 2022).

Several studies have explored the impact of interior architecture on sustainable development and its connection with human well-being (Barbosa et al., 2015; Banaei et al., 2015). Furthermore, integrating sustainable practices that improve indoor air quality and optimize energy efficiency is a key area of focus in environmental sustainability within interior design (Rashdan & Ashour, 2017; Sari, 2024). These studies highlight the significance of critical factors such as ventilation, material selection and waste management. The final group centers on the education and curriculum development within interior architecture, highlighting the incorporation of sustainability principles (Afacan, 2019; Afacan, 2013; Boehm, 2015; Celadyn, 2020; El-Zeney, 2017; Ioannou-Kazamia & Lapithis, 2020; Schneiderman & Freihoefer, 2013; Shu, 2023; Oduho, 2022). These studies explore various strategies for curriculum development to help students embrace sustainable design principles. Additionally, studies examine the attitudes and perceptions of interior architecture students towards sustainability concepts and practices (Bettaieb, 2020; Gale et al., 2014; Ruff & Olson, 2007), as well as how these perceptions evolve over time (Gulwadi, 2009; Gürel, 2010; Stark & Park, 2016). These studies emphasize the role of educational processes in shaping students' understanding of sustainability concepts and the effectiveness of sustainability practices in interior architecture education.



This study discusses the relationship between interior design and the Sustainable Development Goals (SDGs) from a broad perspective, focusing on the social and environmental responsibilities of the profession. The SDGs offer a universal framework for enhancing social welfare and supporting environmental sustainability, and guiding effords to solve pressing global problems. On the other hand, as a profession with the ability to shape living environments and meet environmental obligations, interior architecture, plays an important role to play in advancing the SDGs and improving individual well-being. However, the relationship between these two fields remains underexplored in the literature. In this context, the main objective of this study is to understand the relationship between the interior design profession and the SDGs, and to evaluate the link from a social responsibility perspective. In this

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regard, it aims to contribute to the field by reviewing existing literature and conducting quantitative research on the topic.

The significance of this study lies in its identification of the interior design profession's potential impact on sustainable development, and its effort to raise awareness about the future role of the profession. It is anticipated that the findings will shed light on the development of new approaches in education, practice and interdisciplinary collaboration, enhancing the contribution of interior architecture to the SDGs.

## METHOD OF RESEARCH

A literature review is essential for advancing a research field. It entails the collection of information within a specific area, identifying gaps in the existing literature, and formulating potential topics and questions related to the research area (Şimşir, 2022). The term "bibliometric research" is defined as "a systematic literature review in which bibliographic data are analyzed by bibliographic methods" (Block & Fisch, 2020) through quantitative analyses (Ellegaard & Wallin, 2015). This study conducted a bibliometric analysis of existing literature to examine the connection between sustainable development goals and the discipline of interior architecture. Furthermore, the objective was to collect data that enables the exploration of this field in the context of social responsibility aligned with these goals.



### Method: Bibliometric Analysis

Bibliometric analysis has emerged as a significant methodology for evaluating the scientific outputs, including studies, authors, keywords, journals, institutions and countries across different research domains. It facilitates the analysis of a field's intellectual, social, and conceptual evolution, clarifying the relationships and interactions between these aspects (Aria & Cucurullo, 2017). The principal goal of the analysis is to identify, evaluate and understand the literature (or a specific segment thereof) within a given scientific domain. A bibliometric analysis is a process of examining publications in a particular field or in a academic journal with the help of numerical analyses and statistics on various bibliometric indicators. These metrics include the number of articles published over the years, topics, contributing universities, leading journals, authors, citation counts, keywords and so forth. The aim is to obtain findings on scientific communication (Cobo et al., 2011).

In the context of the study, common word analysis, a bibliometric analysis technique, is employed to identify the core topics of the studies. This analysis looks at the relations between the concepts and words used in the titles, abstracts and keywords of the studies in a specific research field (Aria & Cucurullo, 2017). The co-occurrence of two keywords in different studies within a field is an indicator of the connection between those words. By measuring the strength of the relationship between words through common word analysis, patterns and trends of a particular field or discipline can be revealed; dominant research topics in

DOI: 10.15320/ICONARP.2024.312

a field can be identified; and the relationships between them can be visualized (Donthu et al., 2021; Öztürk, 2020). In the common word analysis technique, the title, abstract and keywords of the study are used as data. The technique identifies main topics or research areas in a given field, the most studied topics/concepts and their relations and the dynamics of conceptual changes can be determined (Bağış, 2022).

**The Processes of Data Collection, Analysis and Evaluation**

In bibliometric research, a four-step process is usually followed to identify relevant literature in a transparent and reproducible manner. This process involves selecting a database, conducting an initial search, filtering the dataset and downloading the results (Öztürk, 2020). The following section outlines the steps carried out in the context of this study.

1. Selection of the database: The Web of Science (WOS) database, which is compatible with bibliometric data analysis software, offers the ability to download data sets, is updated daily, and provides a filtering feature that allows categorization of publications according to Sustainable Development Goals. Thus, it was selected as the preferred database. First released in 1997, this database, produced by the Institute for Scientific Information, is the oldest and most widely used database in the world, and is internationally recognized.

2. Initial search process: The search terms "sustainable development" or "sustainable development goals" and "indoor" or "interior" or "interior design" or "interior architecture" or "interior decoration" were used. A search was conducted in the WOS database using the TOPIC[1] option in the search field for the relevant keyword in the search bar on the Basic Search screen.

[1] With this search option, the relevant keyword is searched in title, abstract, author keywords and Web of Science keywords.

3. Filtering: In the results screen, the year 2015, when the Sustainable Development Goals were adopted, was identified as the starting point to 2023. In the initial stage of the process, no filtering was applied to the other search options.

4. Downloading the data set: The data for preparing the relevant graphs were downloaded by selecting the desired parameter that appears after selecting 'Analyze Result' on the result screen and then selecting the 'Download data table' option. The data used in the common word analysis were downloaded in PlainText file format, which is compatible with the VOSviewer bibliometric analysis program, from the export button located in the top left corner of the result screen. To do so, the Full Record option was selected from the Export Records to PlainText File option. The data were imported into the VOSviewer bibliometric analysis program.

The analysis results were interpreted based on their answers to the research questions. The research questions were evaluated under the two sub-headings; former the general trend and orientation of the literature were determined later the structure and basic dynamics of the research area.

## FINDINGS

A search was conducted using the defined keywords[2], and 861 results covering the years 1993-2023 were retrieved. Upon filtering the results to include only those published between 2015 and 2023, 640 publications were identified. The literature, which began with a modest number of publications in 2015, the year the Sustainable Development Goals were adopted and the research period started, has shown a steady upward trend through 2023. The analysis titles, aligned with the research questions, are presented below.

[2] The data obtained from the search results on 13/03/2024 was employed in the study.

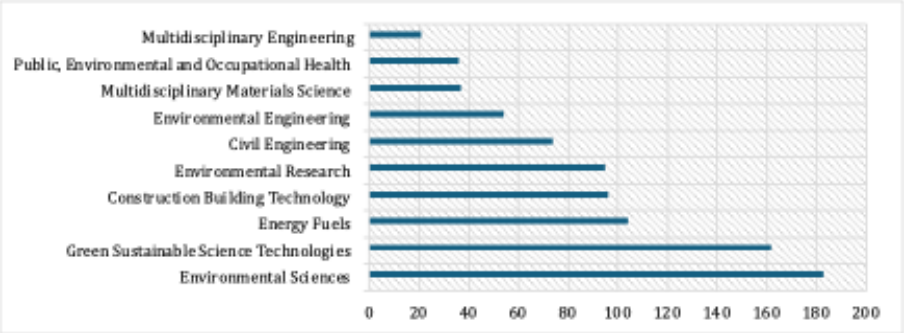
### Analysis of the Research Topic in the Perspective of Disciplines and Sustainable Development Goals

### Distribution of Publications by Scientific Field Category

The distribution of publications according to the scientific field category has been presented in a graph with reference to the WOS database category. This graph demonstrates the positioning ot the study's topics within academic disciplines and highlights the fields are most associated with the searched keywords. Publications related keywords were classified into 124 different categories in the WOS database and the graph presents data for the top 10 categories with the highest publications counts.

**Graph 1:** Distribution of publications by Web of Science category






As illustrated in Graph 1, the categories with the highest number of publications are Environmental Sciences and Green Sustainable Science Technologies. Categories with a moderate number of publications are Energy Fuels, Construction Building Technology, Environmental Research, Civil Engineering and Environmental Engineering. The categories Multidisciplinary Materials Science, Public, Environmental and Occupational Health and Multidisciplinary Engineering have relatively fewer publications. It is worth noting that the field of interior architecture is absent as a distinct category within the WOS database. However, due to its significant role in sustainability and environmental issues, interior architecture is likely categorized under fields with a medium or low number of publications. This suggests that interior architecture can occupy a position within a diverse range of disciplines and engage with multiple academic fields.

DOI: 10.15320/ICONARP.2024.312

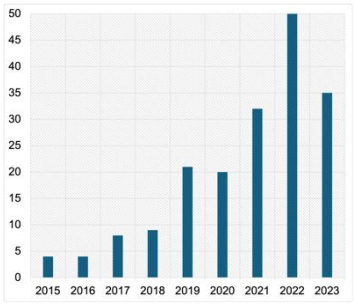
## Distribution of Publications According to WOS Scientific Field Category by Year

The annual distribution of publications by WOS Scientific Field category (Table 1) illustrates the publications across the 10 scientific fields with the highest publication counts. There has been a notable increase over time in the categories of Environmental Sciences (Graph 2), Green Sustainable Science Technologies (Graph 3), Construction Building Technology (Graph 5), and Environmental Research (Graph 6). Meanwhile, Energy Fuels (Graph 4), Civil Engineering (Graph 7) and Environmental Engineering (Graph 8) show an overall upward trend, though with periodic declines. However, the number of publications in all these categories decreased in 2023.

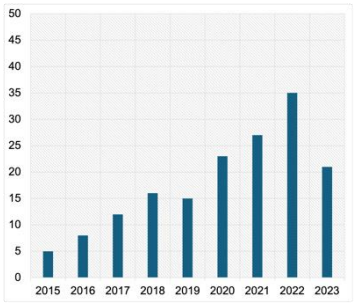
A comparison of the number of publications in Multidisciplinary Materials Science (Graph 9), Public, Environmental and Occupational Health (Graph 10), and Multidisciplinary Engineering (Graph 11) shows a relatively low and fluctuating trend compared to other categories. However, these categories saw an upward trend in recent years (2022-2023). Furthermore, the categories Construction Building Technology (Graph 5), Environmental Engineering (Graph 8), Multidisciplinary Materials Science (Graph 9) and Public, Environmental and Occupational Health (Graph 10) have doubled or tripled compared to previous years.

**Table 1.** Distribution graphs of publications according to web of science category by year

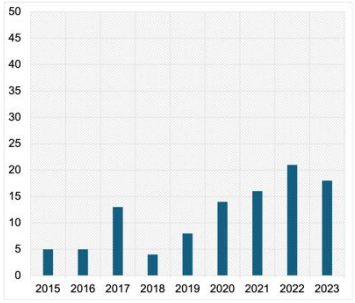
**Graph 2:** Environmental Sciences



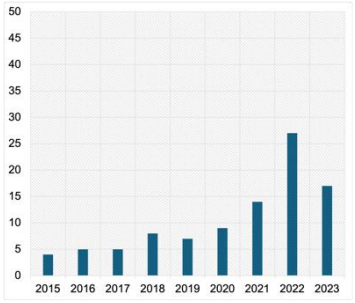

**Graph 3:** Green Sustainable Science Technologies



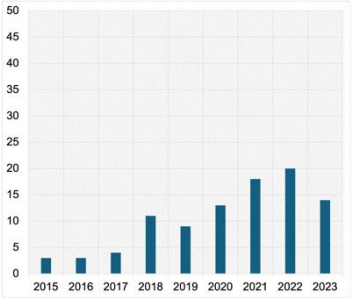

**Graph 4:** Energy Fuels



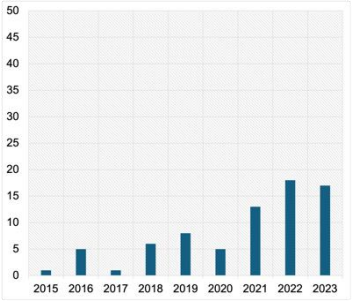

**Graph 5:** Construction Building Technology



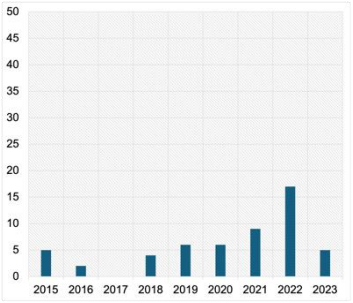
**Graph 6:** Environmental Research



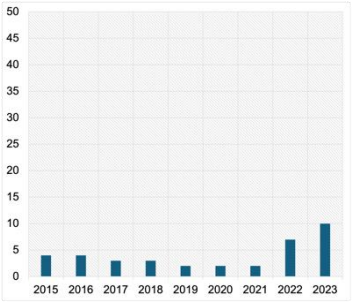

**Graph 7:** Civil Engineering



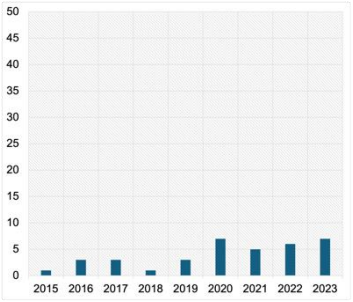

**Graph 8:** Environmental Engineering



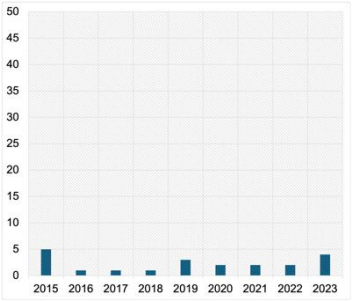

**Graph 9:** Multidisciplinary Materials Science




**Graph 10:** Public, Environmental and Occupational Health




**Graph 11:** Multidisciplinary Engineering





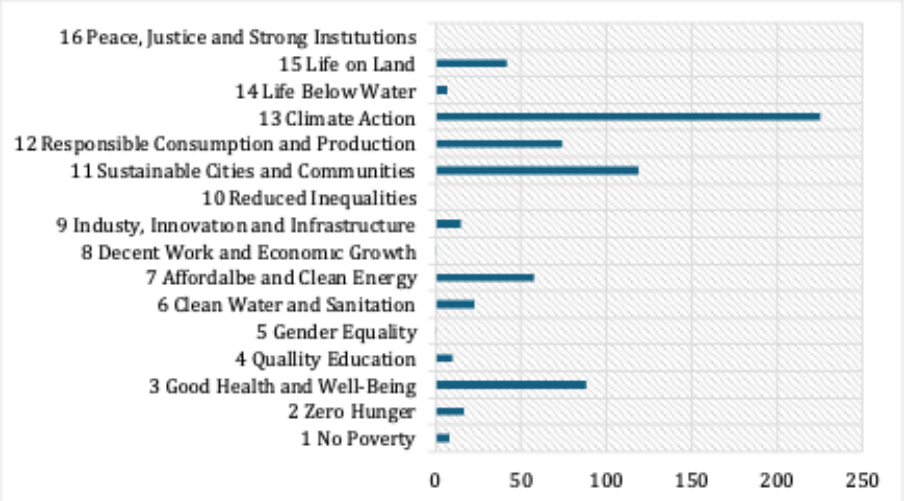

## Distribution of Publications by Sustainable Development Goals

The graph of publication distribution according to sustainable development goals (Graph 12) illustrates how the analyzed publications align with the sustainable development goals. Partnerships for the Goals (SDG 17) is not included in the graph, as it is not among the options available for searching the database by filtering according to sustainable development goals.

Climate Action (SDG 13) leads with the most publications, comprising 32.7% of the total, while Sustainable Cities and Communities (SDG 11) ranks second with 17.3%. Health and Quality of Life (SDG 3) with 12.8%, Responsible Production and Consumption (SDG 12) with 10.8%, Accessible and Clean Energy (SDG 7) with 8.4% and Life on Land (SDG 15) with 6.1% have medium coverage, collectively accounting for 38% of the total publications.

DOI: 10.15320/ICONARP.2024.312

**Graph 12.** Distribution of Publications by Sustainable Development Goals




Clean Water and Sanitation (SDG 6) with 3.3%, Zero Hunger (SDG 2) with 2.4%, Industry, Innovation, and Infrastructure (SDG 9) with 2.2%, Quality Education (SDG 4) with 1.45%, Zero Poverty (SDG 1) and Life on Water (SDG 14) with 1% have low coverage, comprising 11.6% of the total. Decent Work and Economic Growth (SDG 8), Gender Equality (SDG 5) and Reducing Inequalities (SDG 10), Peace, Justice, and Strong Institutions (SDG 16) have no publications associated with them.

**Publication Distribution of Sustainable Development Goals by Year**

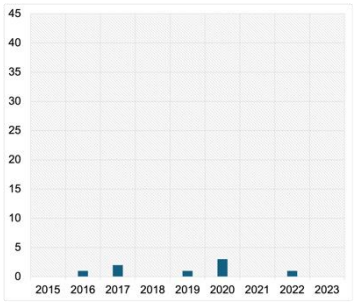


The publication distribution graphs for the Sustainable Development Goals (SDGs) by year (Table 2) illustrate the evolution of publications over time. The graphs are divided into four groups based on shared characteristics. A review of publications in Graph 15-Good Health and Well-Being (SDG 3), Graph 20-Sustainable Cities and Communities (SDG 11), Graph 21-Responsible Consumption and Production (SDG 12), and Graph 22-Climate Action (SDG 13) reveals a more stable trend with higher publication numbers than other categories. While fluctuations are evident in certain years, the overall trend remains relatively stable. Graphs 17, 18, 23 and 24, representing Clean Water and Sanitation (SDG 6), Affordable and Clean Energy (SDG 7), Life Below Water (SDG 14) and Life on Land (SDG 15) respectively, indicate a general upward trend. However, decreases are observed in certain years over time. In particular, there have been increases of up to twofold since 2021.

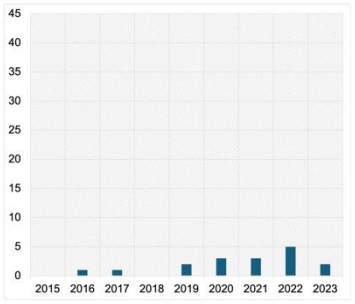
Analysis of Graphs 13, 14, 16, 19, reveals that this group with a limited number of publications exhibits a fluctuating trend with a notable decrease in 2023. A single publication was recorded for Gender Equality (SDG 5) in 2021, and another for Decent Work and Economic Growth (SDG 8) in 2015. Regarding the Peace, Justice and Strong Institutions (SDG 16) target, two publications were identified in 2019 and 2022. No publications were found for the Reduced Inequalities (SDG 10) target. It is important to noted that these goals are not represented graphically due to the statistically insignificant number of publications.

**Table 2.** Publication distribution graphs of sustainable development goals by year

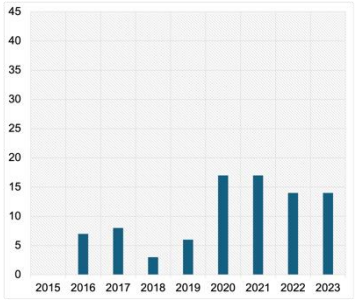
**Graph 13:** SDG 1 No Poverty



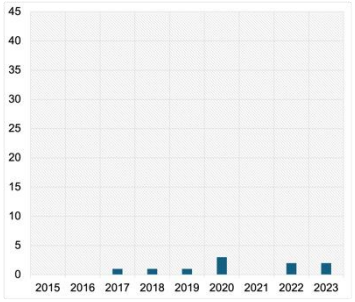

**Graph 14:** SDG 2 Zero Hunger



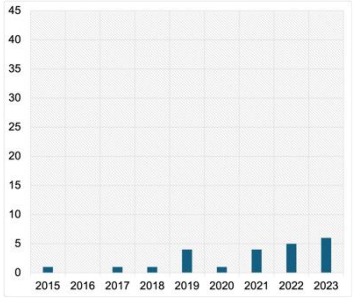

**Graph 15:** SDG 3 Good Health and Well-Being



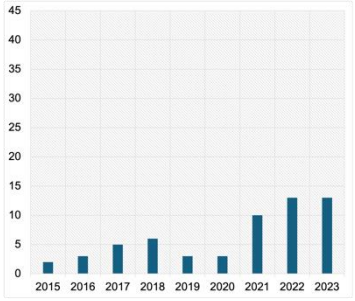

**Graph 16:** SDG 4 Quality Education



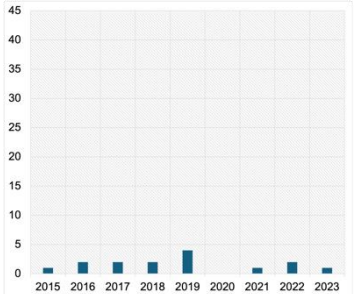

**Graph 17:** SDG 6 Clean Water and Sanitation



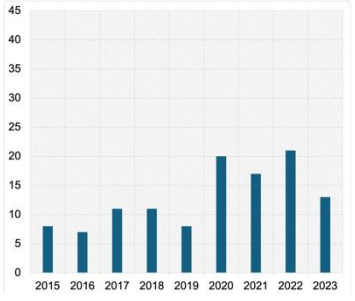

**Graph 18:** SDG 7 Affordable and Clean Energy




**Graph 19:** SDG 9 Industy, Innovation and Infrastructure




**Graph 20:** SDG 11 Sustainable Cities and Communities



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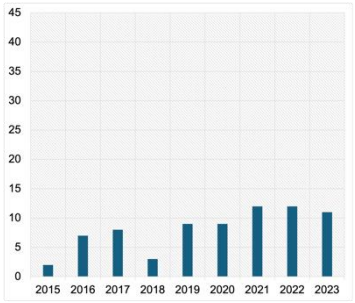
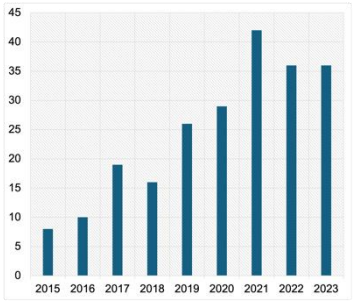
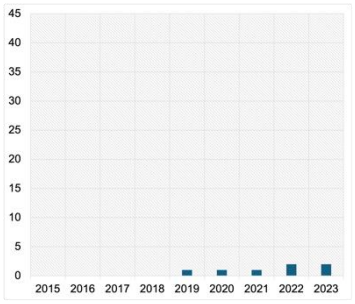
**Graph 21:** SDG 12 Responsible Consumption and Production



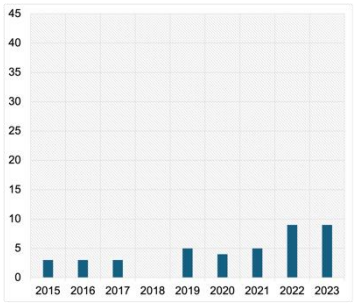

**Graph 22:** SDG 13 Climate Action




**Graph 23:** SDG 14 Life Below Water




**Graph 24:** SDG 15 Life on Land



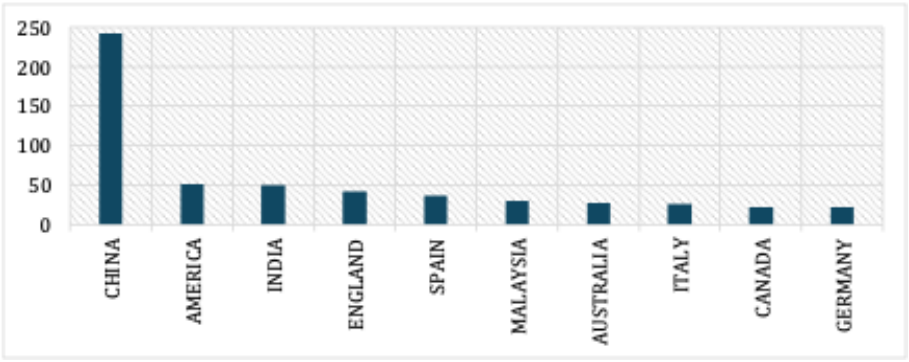

## Analysis of Publications in the Perspective of Geographical Data

### Distribution of Publications by Countries and Continents

The distribution of publications by country and continent provides a valuable metric of global academic activity and interest in sustainable development and interior architecture. The data shoe a clear view of the geographical spread on sustainable development and interior architecture, reflecting global interest in the field. Additionally, a publication distribution analysis can give researchers insights into which regions should focus more on these topics. The keywords were analyzed in 99 countries in the WOS database, and the data for the top 10 countries with the most publications were visualized in the graph.

A detailed review of Graph 25 reveals that China leads with 37.8% of the total publications, followed by the United States (8%) and India (7.8%). The United Kingdom (6.5%), Spain (5.7%), Malaysia (4.6%), Australia (4.2%), Italy (4%), Canada (3.4%), and Germany (3.4%) exhibit comparable rates.

**Graph 25.** Distribution of publications by country



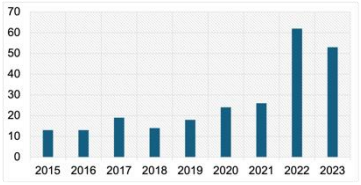
A comparison of publication distribution by continent reveals that Asia leads with the highest number of publications. It is noteworthy that a substantial portion of Asia's total publications comes from contributions by countries such as China and India. Europe ranks second after Asia, achieving significant numbers overall despite many countries publishing at average or low levels. The main contributors to Europe include England, Spain, Germany, and Italy. North America, primarily through the United States, has a moderate level of publications overall.

## Publication Distribution of Countries by Years

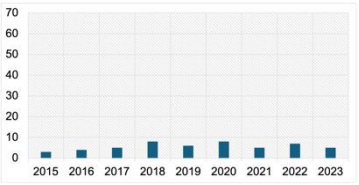
The publication distribution graphs of the top 10 countries by year (Table 3) illustrate the dissemination of academic studies on interior architecture in the context of sustainable development goals across various countries over time. These graphs demonstrate the research trends of countries on this subject over time.

**Table 3.** Publication distribution graphs of countries by year

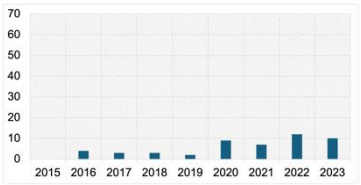
**Graph 26:** Publication Distribution of the China by Year Poverty



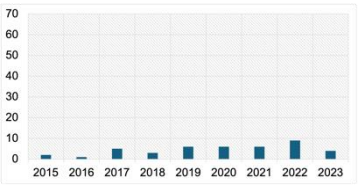

**Graph 27:** Publication Distribution of the USA by Year



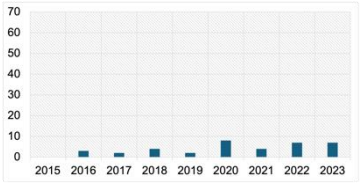

**Graph 28:** Publication Distribution of the India by Year



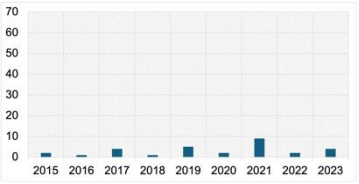

**Graph 29:** Publication Distribution of the England by Year



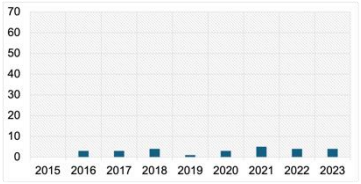

**Graph 30:** Publication Distribution of the Spain by Year



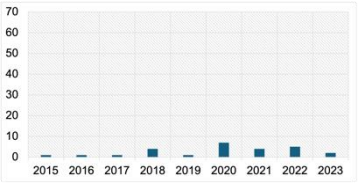

**Graph 31:** Publication Distribution of the Malaysia by Year




**Graph 32:** Publication Distribution of the Australia by Year




**Graph 33:** Publication Distribution of the Italy by Year



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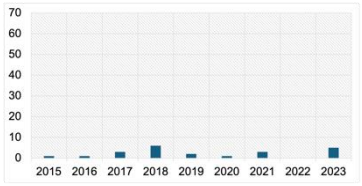
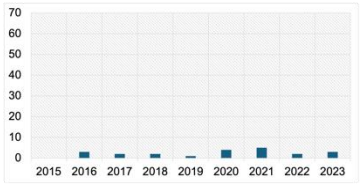
**Graph 34:** Publication Distribution of the Canada by Year




**Graph 35:** Publication Distribution of the Germany by Year




In 2015, after the Sustainable Development Goals were adopted, countries such as China, the USA, the UK, Italy, and Canada began publishing relevant material. Subsequently, other countries began contributing publication as well. China (Graph 26) has consistently demonstrated a high level of output marked by a sharp rise in 2022 and 2023. The United States (Graph 27) shows some fluctuations in its publications count, yet the overall trend remains stable.

The number of publications in India (Graph 28) and Spain (Graph 30) exhibits a fluctuating pattern, but both countries experienced a significant increase in 2020. While the number of publications are relatively low in the UK (Graph 29), Malaysia (Graph 31), Australia (Graph 32), Italy (Graph 33), Canada (Graph 34) and Germany (Graph 35), there is a discernible trend of fluctuation in the number of publications.

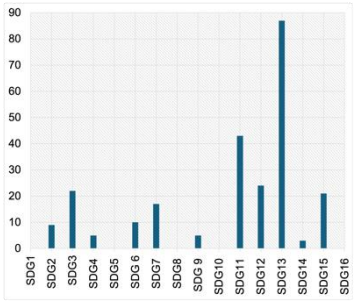
## Distribution of Publications by Sustainable Development Goal of Countries



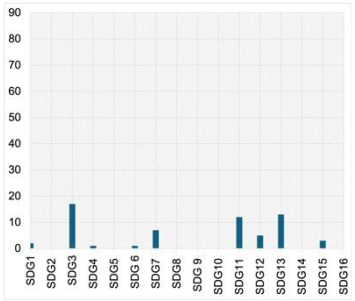
The publication distribution graphs of countries by sustainable development goal (Table 4) demonstrate the numerical distribution of academic studies conducted by different countries with an emphasis on specific sustainable development goals. These graphs reveal which countries contribute most to specific development goal. The findings presented in the graphs in Table 4 are further examined in Table 5, which shows an aggregate distribution of publications by sustainable development goal for different countries.

**Table 4.** Publication distribution graphs of countries according to sustainable development goals

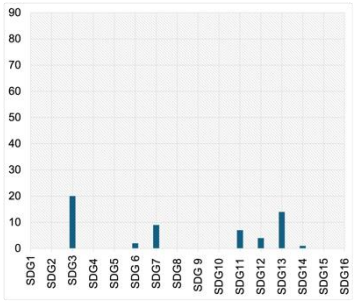
**Graph 36:** Distribution of China's Publications by SDGs



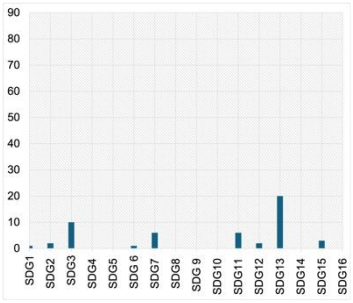

**Graph 37:** Distribution of ABD's Publications by SDGs



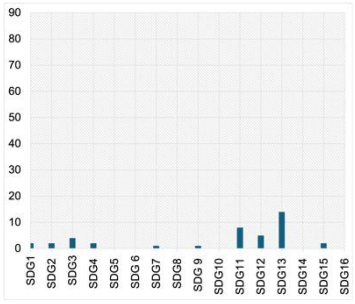
**Graph 38:** Distribution of India's Publications by SDGs



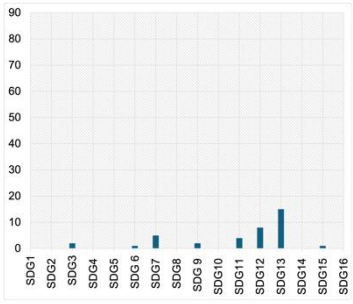

**Graph 39:** Distribution of England's Publications by SDGs



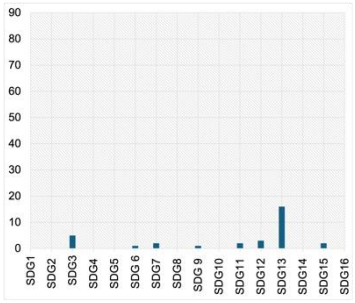

**Graph 40:** Distribution of Spain's Publications by SDGs



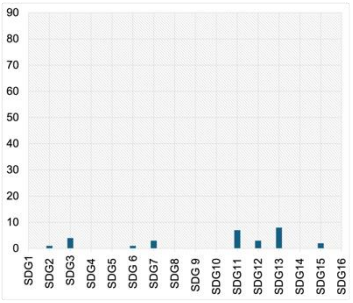

**Graph 41:** Distribution of Malaysia's Publications by SDGs



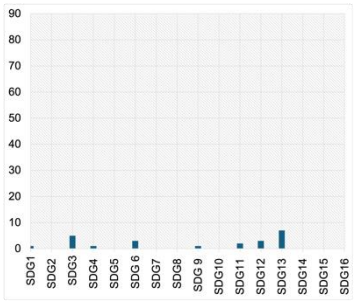

**Graph 42:** Distribution of Australia's Publications by SDGs



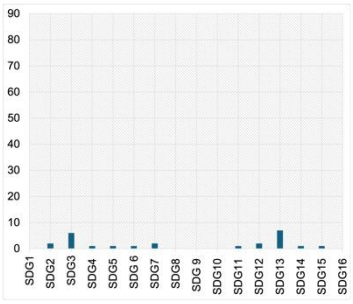

**Graph 43:** Distribution of Italy's Publications by SDGs




**Graph 44:** Distribution of Canada's Publications by SDGs




**Graph 45:** Distribution of Canada's Publications by SDG




According to the table, Climate Action (SDG 13) is the most studied goal, with the highest publication numbers across most countries, except India (Graph 38) and the USA (Graph 37). China contributes the most to this target. All countries have published studies related to this target. In India (Graph 38) and the USA (Graph 37), the Good Health and Well-Being (SDG 3) has the highest number of publications. SDG 3 is also frequently addressed in most countries, except Malaysia (Graph 41). Sustainable Cities and Communities (SDG 11) is the most published target in China (Graph 36), the USA (Graph 37), Spain (Graph 40) and Italy (Graph 43).



DOI: 10.15320/ICONARP.2024.312

India (Graph 38), the UK (Graph 39), Malaysia (Graph 41), Australia (Graph 42), Italy (Graph 48) and Canada (Graph 44) are countries with medium level of publications in this target. In most countries, Affordable and Clean Energy (SDG 7) is a target with a moderate number of publications, except Spain (Graph 40), Australia (Graph 42) and Germany (Graph 45). Responsible Consumption and Production (SDG 12) stands out as a prominent target with a significant number of publications in Malaysia (Graph 41). For this target, China (Graph 36), USA (Graph 37), Spain (Graph 40), Australia (Graph 42), Italy (Graph 43) and Canada (Graph 44) show medium level of publications. No Poverty (SDG 1), Quality Education (SDG 4), Industry, Innovation, and Infrastructure (SDG 9), and Life Below Water (SDG 14) have low or no publications. Unlike other countries, Canada (Graph 44) for Clean Water and Sanitation (SDG 6) and China (Graph 36) for Life on Land (SDG 15) stand out with a moderate number of publications. For Gender Equality (SDG 5), Germany (Graph 45) is the only country to contribute the target. No country has published on Decent Work and Economic Growth (SDG 8), Reduced Inequalities (SDG 10) and Peace, Justice, and Strong Institutions (SDG 16). China (Graph 36) and Germany (Graph 45) did not publish on 5 sustainable development goals, while other countries did not publish on 7 or more goals.

**Table 5.** Publication distribution density of countries according to sustainable development goal

| | 1 No Poverty | 2 Zero Hunger | 3 Good Health and Well-Being | 4 Quality Education | 5 Gender Equality | 6 Clean Water and Sanitation | 7 Affordable and Clean Energy | 8 Decent Work and Economic Growth | 9 Industry, Innovation and Infrastructure | 10 Reduced Inequalities | 11 Sustainable Cities and Communities | 12 Responsible Consumption and Production | 13 Climate Action | 14 Life Below Water | 15 Life on Land | 16 Peace, Justice and Strong Institutions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| China | – | ■ | ■ | ■ | – | ■ | ■ | – | ■ | – | ■ | ■ | ■ | ■ | ■ | – |
| ABD | ■ | – | ■ | ■ | – | ■ | ■ | – | – | – | ■ | ■ | ■ | – | ■ | – |
| India | – | – | ■ | – | – | ■ | ■ | – | – | – | ■ | ■ | ■ | ■ | – | – |
| England | ■ | ■ | ■ | – | – | ■ | ■ | – | – | – | ■ | ■ | ■ | – | ■ | – |
| Spain | ■ | ■ | ■ | – | – | – | ■ | – | ■ | – | ■ | ■ | ■ | – | ■ | – |
| Malaysia | – | – | ■ | – | – | ■ | ■ | – | ■ | – | ■ | ■ | ■ | – | ■ | – |
| Australia | – | – | ■ | – | – | ■ | ■ | – | ■ | – | ■ | ■ | ■ | – | ■ | – |
| Italy | – | ■ | ■ | – | – | ■ | ■ | – | – | – | ■ | ■ | ■ | – | ■ | – |
| Canada | ■ | – | ■ | ■ | – | ■ | – | – | ■ | – | ■ | ■ | ■ | – | – | – |
| Germany | – | ■ | ■ | ■ | ■ | ■ | ■ | – | – | – | ■ | ■ | ■ | ■ | ■ | – |

■ Very high number of publications %30-%50 ■ High number of publications %20-%30 ■ Number of mid-level publications %10-%20 ■ Low number of publications %1-%10 – Unpublished

## Main Themes in the Literature and Identification of Relevant Sustainable Development Goals

### Common-Word Analysis

The analysis of recurring keywords in the publications revealed 2,387 distinct keywords, with "used at least five times" set as the inclusion

threshold. This threshold was selected to ensure a more balanced distribution of the 2,387 keywords, thereby enhancing the reliability and significance of the results. Applying a frequency threshold (a minimum of five instances) allows for comprehensive analysis by including sufficiently repeated keywords while excluding infrequent terms that could disrupt coherence. Accordingly, in this analysis, a minimum of five instances was established as the inclusion threshold, helping to identify primary themes and trends. With this defined threshold, 39 frequently utilized words were identified. The examination of the keyword map revealed six clusters, each represented by a distinct color (Figure 1).

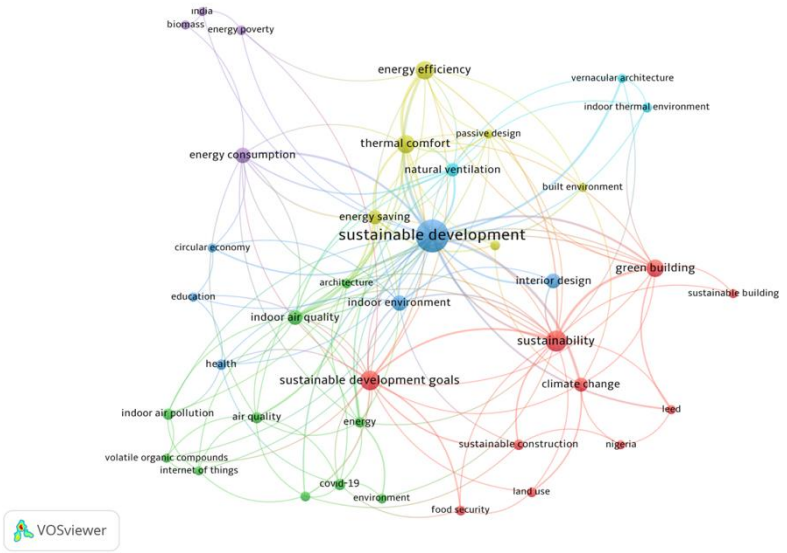



**Figure 1.** Bibliometric network analysis map obtained from common-word analysis in VOSviewer.

Keywords within the blue cluster are mainly focused on sustainable development, a central theme related to all other clusters. The remaining keywords in this cluster are indoor environment, interior design, circular economy, education, and health. This cluster covers general concepts related to sustainable development and interior design. It concentrates on subjects that address sustainability through the lenses of economy, education, and health.

The red cluster includes keywords sustainable development goals, sustainability, green building, climate change, sustainable construction, sustainable building, food security, land use, Leadership in Energy and Environmental Design (LEED), Nigeria. This cluster focuses on environmental issues in general, sustainable construction practices, social factors, and specific regional issues.

The yellow cluster features keywords like thermal comfort, energy efficiency, energy saving, solar energy, passive design, and the built environment. This cluster primarily addresses energy-oriented sustainable issues in the built environment.

The purple cluster encompasses the keywords energy consumption, energy poverty, biomass, and India. This cluster emphasizes the sustainable utilization of energy sources. The number of keywords in this



DOI: 10.15320/ICONARP.2024.312

cluster is relatively limited and their interrelations among them are relatively week.

The green cluster includes keywords such as indoor air quality, architecture, energy, the environment, indoor air pollution, and air quality, particularly in the context of the ongoing pandemic. It also includes volatile organic compounds (VOCs), a significant concern in the current climate. This cluster addresses environmental health issues such as air pollution and quality in the context of energy, technology, and pandemics.

Similar to the purple cluster, the turquoise one is a smaller in size compared to the others. It includes keywords related to natural ventilation, indoor thermal environments and vernacular architecture with an emphasis on natural and sustainable building practices.

**EVALUATION of FINDINGS**

A review of publication distribution by scientific field reveals that Environmental Sciences, Green Sustainable Science Technologies, and Energy Fuels have the highest number of publications. This may indicate that interior architecture and environmental sustainability, sustainable technologies and energy efficiency/saving/consumption, renewable energy, sustainable energy solutions and other related fields are being addressed in a comprehensive manner. The categories with moderate publication numbers are Environmental Research, Environmental Engineering, Construction Building Technology, and Civil Engineering. These disciplines include high-impact environmental applications, offering insights to the relationship between interior architecture and sustainable construction technologies. It may indicate that issues related to sustainable building technologies, construction techniques and engineering studies are frequently addressed.



The observed rising trend in categories such as Environmental Sciences, Green Sustainable Science Technologies, Energy Fuels, Environmental Research, and Environmental Engineering may reflect a growing emphasis on sustainable technologies and environmental issues in interior production. Additionally, a notable upward trend was also observed in the categories of Construction Building Technology and Civil Engineering over time.

Following the adoption of the Sustainable Development Goals (SDGs), discussions have increasingly focused on the relationship between the sector and sustainability, particularly due to the growing awareness of the environmental impacts associated with the building and construction industry. The increase in publications on this subject may indicate a similar shift in the interior architecture profession, highlighting advancements in sustainable building technologies and methods.

The categories of Multidisciplinary Material Science, Public, Environmental and Occupational Health and Multidisciplinary Engineering have relatively few publications. Nevertheless, these categories illustrate the growing association between interior

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architecture and broader scientific and engineering perspectives. The upward trajectory in the graphs of recent years indicates a significant rise in research and development activities. Despite its absence as a title in the WOS scientific field category, interior architecture plays an important role in the analyzed studies, either directly or indirectly. This situation highlights the interaction of interior architecture with other disciplines and its contribution to formulating strategies that align with sustainable development goals.

The targets with the highest publication numbers are Climate Action (SDG 13), Sustainable Cities and Communities (SDG 11) and Good Health and Well-Being (SDG 3). This may indicate that these goals are highly relevant to interior design, reflecting a strong awareness of addressing climate change and developing livable, accessible, sustainable cities, settlements and spaces that improve the quality of human life. The targets of Responsible Consumption and Production (SDG 12), Affordable and Clean Energy (SDG 7), and Life on Land (SDG 15) have a moderate number of publications. Interior architecture can directly contribute to these goals through material selection, waste management, energy reduction, energy-efficient building design and the use of renewable energy sources. The number of publications reinforces this orientation and potential.

There is evidence of a consistent upward trend in the indicators related with the Sustainable Development Goals (SDGs), particularly those focused on Good Health and Well-Being (SDG 3), Sustainable Cities and Communities (SDG 11), Climate Action (SDG 13) and Responsible Consumption and Production (SDG 12). This suggests that these areas occupy a significant position in sustainability research and reflect a growing interest in these topics. The substantial rise in Good Health and Well-Being (SDG 3) and Sustainable Cities and Communities (SDG 11) in 2020 could be interpreted as a result of the pandemic, which likely heightened interest in these targets. Clean Water and Sanitation (SDG 6), Zero Hunger (SDG 2), Industry, Innovation, and Infrastructure (SDG 9), Quality Education (SDG 4), No Poverty (SDG 1) and Life Below Water (SDG 14) are the targets with the fewest publications. This may suggest of a lack of awareness about the direct applicability or relevance of these goals to interior architecture practice.



The upward trend in Clean Water and Sanitation (SDG 6), Affordable and Clean Energy (SDG 7), Life Below Water (SDG 14) and Life on Land (SDG 15) since 2000 may indicate growing interest and increasing significance of these topics in sustainability research. The low and fluctuating publication counts for No Poverty (SDG 1), Zero Hunger (SDG 2), Quality Education (SDG 4) and Industry, Innovation and Infrastructure (SDG 9) suggest inconsistent research interest in these areas. This highlights the need for further research and support in these targets.

Decent Work and Economic Growth (SDG 8), Gender Equality (SDG 5), Reduced Inequalities (SDG 10) and Peace, Justice and Strong Institutions (SDG 16) remain unpublished targets. This suggests insufficient

DOI: 10.15320/ICONARP.2024.312

exploration of Interior Architecture's contribution to these goals, as well as a need for further research on social equality and economic growth.

A review of the literature reveals that China leads significantly in both volume and distribution of publications, as well as in aligning these with sustainable development goals. This prominence may result from China's rapid urbanization and growing awareness of sustainable development, driving efforts to address social, economic and environmental challenges. The USA and India follow China's lead, indicating that research in the academy in these countries also emphasizes interior space in relation to sustainable development goals.

An evaluation of publication distribution across countries by sustainable development goals reveals that high or medium-level publications are prevalent in Climate Action (SDG 13), Sustainable Cities and Communities (SDG 11), Good Health and Well-Being (SDG 3), Responsible Consumption and Production (SDG 12) and Affordable and Clean Energy (SDG 7). This may indicate that climate change, urbanization, human health and quality of life, sustainable resource use and waste management, use of energy resources and energy efficiency are global concerns for interior architecture research. Variations in publication profiles among countries may be due to factors such as financial resources, government policies, academic infrastructure and national research priorities.

A common word analysis was conducted on the primary themes identified in the literature and the corresponding Sustainable Development Goals (SDGs). The central positions of the blue and red clusters along with their multiple relationships to other clusters emphasize the broad connection between interior architecture and SDGs. This analysis demonstrates that interior architecture and space design can be incorporated into various sub-headings of sustainable development and directly linked to sub-topics. Additionally, it provides insights to deepen the understanding of the interconnection between the interior architecture profession and the SDGs. Table 6 illustrates the primary themes identified from the literature and their associated SDGs.



An analysis of Table 6 reveals that all clusters, except the blue cluster, align with the objective of Affordable and Clean Energy (SDG 7). This is followed by Climate Action (SDG 13) and Sustainable Cities and Communities (SDG 11). This distribution reflects the publication distribution trends according to Sustainable Development Goals.

The blue, green, and turquoise clusters are the most pertinent to interior architecture and interior space design, based on their keywords and established relationships. The blue cluster directly relates to interior design reflecting the field's primary focus on the study of the interior environment. The relationship established with keywords such as circular economy, health, and education may indicate that the contributions of interior architecture to sustainable development goals are positioned around these issues. The green cluster is related to indoor air quality and pollution, while the turquoise cluster focuses on natural

ventilation and indoor thermal environment, emphasizing the direct link between interior architecture and user health. These clusters intersect at the Good Health and Well-Being (SDG 3) target.

**Table 6.** Main themes in the literature and related sustainable development goals

| | 1 No Poverty | 2 Zero Hunger | 3 Good Health and Well-Being | 4 Quality Education | 5 Gender Equality | 6 Clean Water and Sanitation | 7 Affordable and Clean Energy | 8 Decent Work and Economic Growth | 9 Industy, Innovation and Infrastructure | 10 Reduced Inequalities | 11 Sustainable Cities and Communities | 12 Responsible Consumption and Production | 13 Climate Action | 14 Life Below Water | 15 Life on Land | 16 Peace, Justice and Strong Institutions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BLUE CLUSTER | | | ■ | ■ | | | | | | | | ■ | | | | |
| interior space and development | | | | | | | | | | | | | | | | |
| RED CLUSTER | | ■ | | | | | ■ | | | | ■ | ■ | ■ | | | |
| sustainable building and construction practices, environment, and food safety | | | | | | | | | | | | | | | | |
| YELLOW CLUSTER | | | | | | | ■ | | | | ■ | | ■ | | | |
| sustainable built environment and alternative energies | | | | | | | | | | | | | | | | |
| PURPLE CLUSTER | ■ | | | | | | ■ | | | | | ■ | ■ | | | |
| energy management and renewable energy sources | | | | | | | | | | | | | | | | |
| GREEN CLUSTER | | | ■ | | | | ■ | | | | ■ | | | | | |
| structural, spatial design and building physics | | | | | | | | | | | | | | | | |
| TURQUOISE CLUSTER | | | ■ | | | | ■ | | | | ■ | | ■ | | | |
| natural sustainable building practices, vernacular architecture, space comfort | | | | | | | | | | | | | | | | |

## CONCLUSION and SUGGESTIONS

The results of the study revealed that the profession is closely linked to Climate Action (SDG 13), Sustainable Cities and Communities (SDG 11), Responsible Production and Consumption (SDG 12), Health and Quality of Life (SDG 3) and Accessible and Cclean Energy (SDG 7). However, the relationship with critical goals such as Quality Education (SDG 4), Gender Equality (SDG 5) and Reducing Inequalities (SDG 10) remain insufficient. This situation highlights a critical need to expand the scope of research on these goals in the literature.

The discipline of interior design, through its comprehensive approach, can significantly contribute to under-researched sustainable development goals such as Gender Equality (SDG 5) and Reducing Inequalities (SDG 10. Spatial arrangements and design strategies can play a crucial role in promoting gender equality and reducing inequalities. At the same time, creating accessible spaces for people with disabilities, older adults and other disadvantaged groups can contribute to reducing social inequalities. These approaches demonstrate that interior design is not solely about aesthetics and functionality, but also offers solutions for promoting social justice and equality.

Interior design, as reflected in the literature, maintains strong ties with disciplines like environmental science, civil engineering and energy technology. These disciplines contribute significantly to energy efficiency, environmental sustainability and the use of renewable materials. However, in order to strengthen the social dimension of interior design, stronger connections with social sciences like sociology and public health are recommended. Such collaborations are expected to



DOI: 10.15320/ICONARP.2024.312

amplify the impact of interior design on social welfare and support the creation of accessible and equitable spaces for disadvantaged groups.

The literature review indicates that China, the USA and India have a high number of publications on interior design in relation to sustainable development goals. In particular, China's rapid urbanization and focus on sustainability have driven a surge in related research. However, in countries with limited publications, there is a need to raise awareness of sustainable development goals and encourage academic research. In addition, given the diversity of research priorities and focus areas across countries, encouraging cross-country cooperation through interdisciplinary projects is highly recommended. Such collaborations can enable the development of innovative and effective design solutions for specific regional needs while strategically addressing weaknesses by drawing on the strengths of different countries.

In conclusion, the relationship between sustainable development and interior design has evolved over time both quantitatively and qualitatively. The analyses show that interior designers can play a pivotal role in achieving sustainability goals by providing innovative solutions to social and environmental problems through space design. In the light of findings, interior architecture holds an important social responsibility in contributing to sustainable development goals through space design. However, increased awareness of the role of design and spatial planning in achieving these goals, along with enhanced research and interdisciplinary collaboration, is expected to foster more innovative and comprehensive solutions.



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## Resume

*Kübra KAYADURAN MAHİR received her bachelor's degree in interior design from the Faculty of Architecture at Karadeniz Technical University and her Master's degree from the Department of Interior and Environmental Design at Hacettepe University. She is continuing her doctoral education in the same department. She is currently working as a research assistant at Dumlupınar University, Department of Interior Architecture.*

*Duygu KOCA received her bachelor's, master's and doctoral degrees in architecture from Middle East Technical University, Faculty of Architecture. Her doctoral research focused on the relationship between image production/identity/residential architecture in Turkey. She currently works and lectures on interior architecture/architectural inclusive design, residential spaces and design/research methods at the Department of Interior Architecture and Environmental Design.*